

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2017/2018

**TCP2451 – PROGRAMMING LANGUAGE TRANSLATION  
/ TCS3311 – COMPILER DESIGN**

( All sections / Groups )

12 MARCH 2018  
9:00 a.m. – 11:00 a.m.  
( 2 Hours )

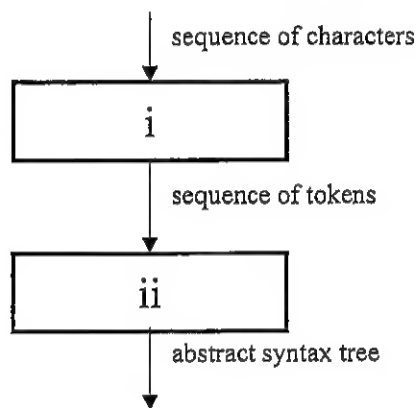
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**INSTRUCTIONS TO STUDENTS**

1. This Question paper consists of **5 pages** only including the cover page with 4 Questions.
2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers **CLEARLY** in the Answer Booklet provided.

**Question 1** (0.5+2+2+4+4 marks)

- (a) What is the definition of programming language translation?
- (b) Give one programming language name example for each of the following translator categories.
- Compiler
  - Interpreter
- (c) Consider the following diagram inside a compiler.



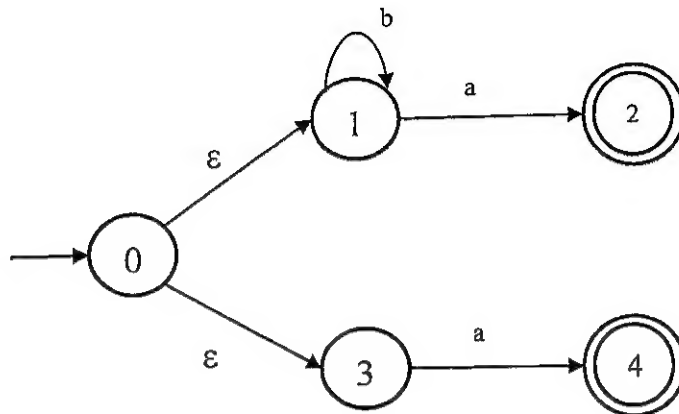
Give the two missing components labelled i and ii.

- (d) Use a programming language to illustrate an example of hybrid translator.
- (e) Why do we need symbol table and error handler in all the phases of a compiler?

Continued.....

**Question 2** (9+3.5 marks)

(a) Consider the following NFA.



- Explain  $\epsilon$ -closure of a state using an example from this NFA.
- Convert the NFA to a DFA using subset construction algorithm. Provide all the necessary steps and the transition table.

(b) Consider the following grammar.

$F \rightarrow T X$   
 $T \rightarrow ( F ) \mid \text{int } Y$   
 $X \rightarrow + F \mid \epsilon$   
 $Y \rightarrow * T \mid \epsilon$

- Find the set for the FIRST(X).
- Find the set for the FIRST(Y).
- Find the set for the FOLLOW(X).
- Find the set for the FOLLOW(Y).

Continued.....

**Question 3** (3+5+3+1.5 marks)

(a) Consider the following Java code.

```
class A {  
    public static void main(String[] myargs) {  
    }  
}
```

Give all the tokens (lexemes and its corresponding types) in table form.

(b) Consider you are given one of the following top-down parsing table non-terminal rows.

	num	-	(	)	\$
E'		→ (E)			→ ε

Write the `parse_EPrime()` procedure using a high-level programming language such as Java.

(c) Give a regular expression to define each of the following in JLex specification format.

- letter of English alphabet
- digit
- Java identifier

(d) Give three out of four section names of Java CUP specification file.

Continued.....

**Question 4** (2+5+4+1.5 marks)

- (a) Give the input and output of the semantic analysis of a compilation process.
- (b) Convert the arithmetic expression  $(a + b * c)$  into each of the following.
- syntax tree
  - three-address code
  - quadruples
  - triples
  - indirect triples
- (c) Construct both the unoptimized syntax tree and directed acyclic graph (DAG) respectively for the expression  $(a + b + (a + b))$ .
- (d) Consider the following machine instruction sequence.

```
MOV j, R0
ADD #1, R0
MOV R0, j
```

Convert the machine instruction sequence to Java statement.

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